BOOK REVIEW

Gender, Science and Mathematics: Shortening the Shadow

L. H. Parker, L. J. Rennie & B. J. Fraser (Eds.)

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This publication is the second in the Kluwer series Science & Technology Education Library, with series editor Ken Tobin from the University of Florida; the three editors are from Curtin University of Technology, Perth. Consequently, although contributing authors give the book an international perspective, it is of particular relevance for Australian audiences. It is intended to be of interest to researchers, policy makers, teacher educators, and practitioners. There are sixteen chapters under three section headings: (a) Confronting Perceptions and Attitudes; (b) The Reality of Schools, Classrooms, Curriculum and Assessment; and (c) From Policy to Practice—Building on Experience. One of the underlying assumptions of the editors is that science and mathematics have many common challenges although they vary in degree. At first glance there appear to be only three or four chapter headings which refer directly to mathematics education, but this should not be a deterrent to readers of this journal who are concerned with issues of gender equity—there are insights to be gained from other chapters, especially if one adopts a broad perspective in relation to educational, social, and political issues. As may be expected from a compilation such as this, the writing styles vary to some extent but this is not a major problem. The styles are not overly academic but provide well-reasoned arguments backed up with substantial research data in the form of tables and/or references. The chapters are independent, and concise—most are about 10 pages in length—so that they could appeal to busy readers and those with eclectic tastes. The two final chapters are about 20 pages long, providing analyses and cross-cultural comparisons between Australia and the United States.

I puzzled over the second part of the title which is drawn from the words of T. S. Eliot:

> Between the idea
> And the reality
> . . . Falls the Shadow

The aim of the book is to shorten the shadow, and the theme is stated thus:

> the key to the translation of gender equity policy into practice lies in working through change agents (for example, teachers, teacher educators and curriculum writers) to ensure that these agents, first, recognise and understand the importance of different world views of science, mathematics, scientists, and mathematicians, second, are able to critique current practices in science and mathematics education with respect to gender equity issues and, third, are familiar with the advantages and disadvantages of a range of strategies for addressing gender issues in mathematics education. (p. xii)

To support the target audience the book draws on recent research and practice examples of strategies and approaches, underpinned by theoretical frameworks, and addresses future developments through discussions of implications for researchers, teacher educators, and classroom practitioners. It is of particular importance then for teacher professional development, in terms of both initial preparation and continuing education.

Two chapters of this book have already been reviewed by Barnes and Horne (1996), so readers may be familiar with some of its contents. However, I will assume this not to be the general case. Rather than summarise all 16 chapters I will focus on those which I consider to be of greater interest to mathematics classroom practitioners and mathematics education researchers.

The chapter by Willis (*Gender Justice and the Mathematics Curriculum: Four Perspectives*) teases out the strands of several issues which had remained clouded in my thinking as my interest in gender equity has grown throughout many years of practice. She identifies four broad perspectives on the relationship between mathematics curriculum, disadvantage, and social justice. The first assumes that the curriculum is taken as more-or-less given. Students who are not adequately prepared are treated as *remedial*, or regarded as having *skill deficits*, and the solution is to provide assistance for that which is lacking.

The second also assumes a fixed curriculum, but pedagogical and assessment practices favour or relate to the experiences, interests, and cultural practices of some social groupings more than others. The proposed solution is to develop *non-discriminatory* practices so that the experiences of all students are recognised in a supportive learning environment with more valid and fair assessment practices.

The third broad perspective identified by Willis views the curriculum as a selection, neither given nor unchangeable, which reflects the values, priorities, and lifestyles of the more powerful members of the dominant culture, and which acts to produce relative advantage. In terms of gender such mathematics curricula tend to reflect masculine rather than feminine characteristics. The solution is to provide curricula which acknowledge, accommodate, value, and reflect the experience of the diversity of social groups, adopting an *inclusive* perspective.

The fourth, a *socially critical* perspective, considers the problem to lie with the way the curriculum positions, classifies, and selects students, in the interests of reproducing the status quo. The solution is to challenge the hegemony in a way that is recognised by all participants. This means helping students to understand and exploit the explicit uses of mathematics in their own interests and in the interests of social justice.

I also found the chapter by Kreinberg and Lewis (*The Politics of Practice and Equity: Experiences from Both Sides of the Pacific*) to be illuminating of my lived experience. Considering bottom-up developments in addressing equity issues for mathematics and science educators in a practical sense, Kreinberg traces the development in the United States of EQUALS (of which the Family Maths Program was but one outcome) and Lewis describes the evolution of the McClintock Collective in Australia. It is important to reflect that progress has not been made in a continuous fashion, but rather, the progres-

sion has been in a series of uneven steps. The authors candidly remark on some of setbacks so that others may learn from these. Lewis applies a six-stage framework to the history of the Victorian movement: (a) the absence of women not being noticed; (b) the search for the missing women; (c) why there are so few women in science; (4) studying women's experience in science; (6) challenging the paradigm of what science is; and (7) the transformed, reconstructed gender-free curriculum. She estimates that the Collective is "hovering between Stage 5 and the beginning of Stage 6" (p. 198). That is, it has challenged the dominant science education paradigm, adopting an issues-driven approach, making connections between science and the lives of the students. The sixth stage would go beyond seeing gender as an organising category and would examine critically the assumptions behind the culture and practice of science and the social construction of masculinity and femininity.

Leder (*Equity in the Mathematics Classroom*), reviews some of her own studies where relatively large samples and statistical techniques were used to draw inferences about gender differences in mathematics. But she notes that this focus on differences rather than similarities tends to "highlight, reinforce and perpetuate popular beliefs and stereotypes about gender differences in mathematics learning" (p. 102). She also presents some results of using an alternative research paradigm along the lines of constructivism, arguing that this micro level research is a timely addition to work on gender differences. She recommends that the classroom environment be sufficiently flexible to accommodate the full range of student needs; and notes that further research is needed in the area of understanding the multifaceted range of interactions in the classroom with concomitant support for teachers at the organisational and content-related levels.

In spite of the limitations of using a categorical system to interrogate gender research, Johnston and Dunne (*Revealing Assumptions: Problematising Research on Gender and Mathematics and Science Education*) adopt the Habermasian framework of three knowledge constitutive interests—technical, practical, and emancipatory. The technical is manifested in the need for control and prediction of the environment, and is strongly connected with positivist philosophy. The practical centres on developing understanding through interaction with the environment: Knowledge is seen to be socially constructed and verified according to consensus. Whereas the first is linked with objectivity in research, the second is linked with hermeneutics and interpretive research. According to Johnston and Dunne, the third (emancipatory) interest adopts a critical perspective. "Knowledge is regarded as socially constructed but the politics of its construction and legitimation are a central and continual concern" (p. 56). They recommend that research shift from the practical and technical interests, which they note are predicated on fixed categories, to a focus which addresses the production of these categories (such as gender) in the framing and undertaking of research, as well as the practical classroom applications of such research findings. They suggest examples of critical questions: "what constitutes mathematics and science, what counts as valued knowledge, and how things came to be this way and how they are sustained" (p. 61). Such ques-

tions could provoke researchers as well as practitioners to look at their field in a new way.

With such a general title for this publication I was personally disappointed that there appeared to be an invisible frame of reference restricting the material to the interests of educating children between the ages of approximately four to eighteen years. Although there were a few passing references to adults, as scientists or (potential) teachers, no reference was made to the growing numbers of adults who are beginning or returning to formal mathematics (or science) education at comparable educational levels. In addition there are substantial numbers of school leavers as well as mature adults, in vocational or community colleges, who are required to undertake studies of mathematical and scientific material at pre-tertiary levels, in preparation for future employment or in order to maintain their current employment. Their needs have not been addressed. Clearly there is a need for further research in this area (and universities as well as governments may be lagging here), but there is certainly a burgeoning research culture which has a focus on the educational needs of adult learners of mathematics. See, for example, FitzSimons, Jungwirth, Maaß and Schloeglmann (1996), and FitzSimons (in press).

Diverging to the area of life sciences in particular, it would have been of interest to learn of any research which investigates the possibility that, in a gendered division of labour, there are relatively more women working at the (generally unrecognised) technician level and fewer at the professional level. There are similar patterns of enrolment in vocational colleges with which I am familiar, and this has implications for career choices of school leavers. The situation may indeed also be replicated for the physical sciences. Perhaps these issues may be addressed in future volumes of this series. There is also scope for the exploration of the intersection of the Mayer competency *Using Mathematical Ideas and Techniques* with technologies other than science, such as business, design, electronics, information, and manufacturing technologies—to name a few.

In conclusion I would recommend the book to mathematics educators who may be acting in roles as practitioners, teacher educators, researchers, or policy makers. It provides a broad overview of research on gender equity in mathematics, together with substantial further reading through the extensive reference lists.

References

Barnes, M., & Horne, M. (1996). Gender and mathematics. In B. Atweh, K. Owens, & P. Sullivan (Eds.), *Research in Mathematics Education in Australasia 1992-1995* (pp. 51-87). Campbelltown, NSW: Mathematics Education Research Group of Australasia.

FitzSimons, G. E. (Ed.) (in press). *Adults (returning to) study mathematics: Papers from the 8th International Congress on Mathematics Education (ICME 8) Working Group 18.* Adelaide, SA: Australian Association of Mathematics Teachers.

FitzSimons, G. E., Jungwirth, H., Maaß, J., & Schloeglmann, W. (1996). Adults and mathematics (Adult numeracy). In A. Bishop, K. Clements, C. Keitel, J. Kilpatrick & C. Laborde (Eds.), *International handbook of mathematics education* (pp. 755-784). Dordrecht: Kluwer.